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FERTILIZER PLACEMENT STUDIES WITH THE POTATO ON PROMINENT SOIL TYPES IN 1932[a]

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Introduction

During recent years considerable attention has been paid to different methods of fertilizer placement. This has resulted largely from the efforts of the Joint Committee on Fertilizer Application, whose membership is drawn from various organizations, including, the American Society of Agronomy, the American Society of Agricultural Engineers, the American Fertilizer Association and the National Association of Farm Equipment Manufacturers. The Joint Committee was formed to consider the subject of fertilizer placement in its broadest aspects and to lend support and counsel to various projects concerned with the proper utilization of plant food materials in relation to different crops.

Up to 1931, the chief fertilizer placement activities concerned corn and cotton. In 1931, as the result of a conference in New Brunswick, New Jersey, at which various agencies were represented, it was decided to establish two fertilizer placement experiments in New Jersey, one on Sassafras loam in the Cranbury section, the other on Sassafras sandy loam near Bridgeton. Shortly after these arrangements were made it was decided to conduct similar studies in Michigan and Ohio. In 1932 the cooperative investigation was extended into Maine and Virginia.

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aPreliminary report covering fertilizer placement studies on potatoes in 1932. Representatives of agencies other than the Department of Agriculture cooperating in the experiments are J. A. Chucka, Maine Agr. Exp. Station; C. E. Miller and Geo. M. Grantham, Michigan Agr. Exp. Station; W. H. Martin, New Jersey Agr. Exp. Station; John Bushnell, Agr. Exp. Ohio Station, and W. O. Strong, Virginia Truck Experiment Station.

Review of Literature

A progress report[1] covering the results obtained in four placement experiments was made to the Joint Committee at its Chicago meeting in November, 1931. The New Jersey results were presented by Martin and Brown[2] at the last annual meeting of the Potato Association in New Orleans and later published in the Proceedings. A condensed report[3] covering the New Jersey work was given by the same writers in Hints to Potato Growers, published by the New Jersey State Potato Association.

Odland and Damon[4] presented results they obtained in Rhode Island on Merrimac silt loam over a period of six years. Five methods of fertilizer placement were compared as follows: (1) Broadcast; (2) In the furrow, cultivated in; (3) In the furrow below the seed with a thin layer of soil placed over fertilizer before planting; (4) Fertilizer above seed, and (5) Applied in narrow bands along both sides of seed pieces. They report, "these results show a rather consistent, although not large difference, in favor of placing the fertilizer below the seed when compared with other furrow placements. All furrow placements were superior to broadcast applications." The below the seed method of placement proved consistently superior to the above the seed method which is in harmony with the results obtained by other investigators. The method of applying the fertilizer, whether by hand or machine, is not stated, but it is assumed the former method was followed.

A report covering the 1932 fertilizer placement work with potatoes was made to the Joint Committee on Fertilizer Application at its meeting in Washington, D. C., November 16, 1932.

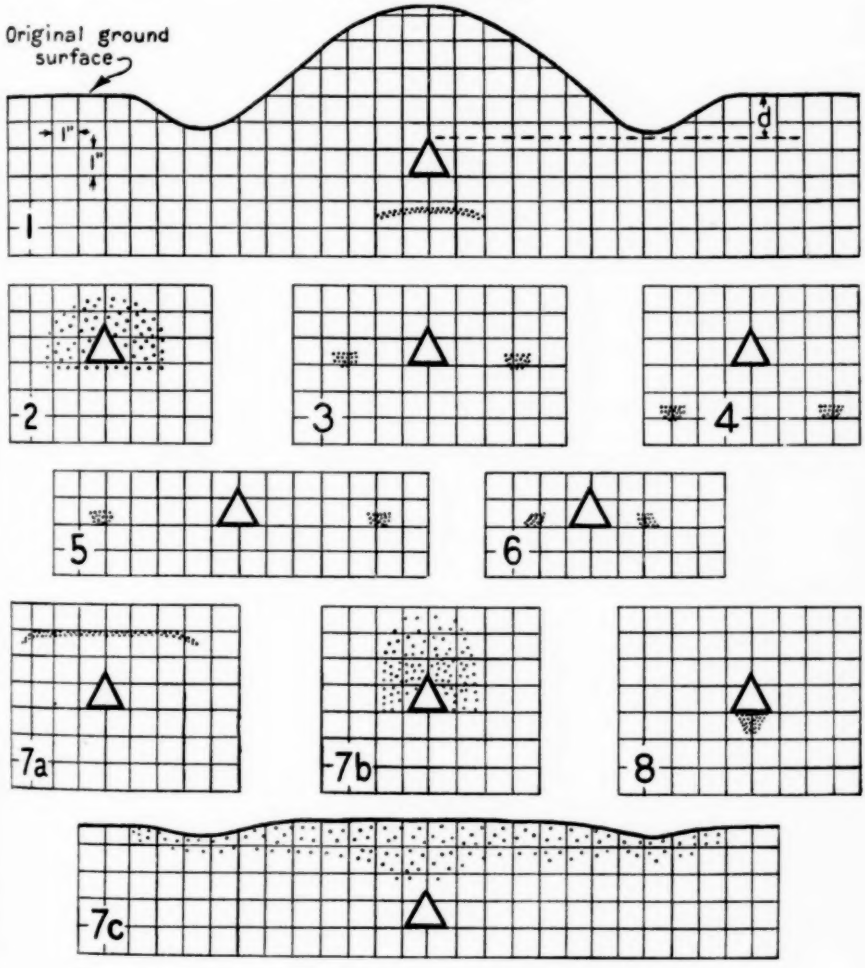
Experimental Work in 1932

The present report deals with fertilizer placement studies with potatoes in Maine, Michigan, New Jersey, Ohio and Virginia. These widely separated potato producing sections obviously afford a wide range of soil types and diversity of climatic conditions. By comparing similar methods of fertilizer placement in all of these sections it was felt that a clearer idea would be obtained concerning their relative value in promoting an economical usage of fertilizer and in lowering potato production costs.

The greatest agricultural significance connected with this problem is—What effect will such methods have on actual yields? Since considerable data pertaining to more detailed studies are not available for presentation at this time, this report will deal primarily with yields

alone. In connection with certain studies involving a great many individual potato hills, brief reference will be made to this phase of the work later in the report.

CHART 1—*Fertilizer placements—Cooperative potato projects, 1932 Onley, Va., Cranbury, N. J., Presque Isle, Me., Wooster, O., and Greenville, Mich.*



d = Distance from original ground level to top of seed piece.
d = 1½" for Onley, Va., Cranbury, N. J.
d = 2½" for Presque Isle, Me., Wooster, O., and Greenville, Mich.

Placements 1, 2, 3, 4, 5, 6 at all locations.
7a, Onley, Va., Cranbury, N. J., and Wooster, O.
7b, Presque Isle, Me.
7c, Greenville, Mich. (after operation of soil packer).
8 , Wooster, O., only.

Seven methods of fertilizer placement were compared during 1932.[a] These are given with the yields in table 1 and also in the accompanying chart.

Table 1 gives the results obtained in the five states with ordinary and double strength fertilizer mixtures whose analysis varied chiefly in accordance with local practice. In the footnotes to table 1 information is given concerning varieties grown, actual analyses employed and rates of fertilizer application. In all of the fertilizer placement work the fertilizer was applied by machine provided with the necessary parts to insure obtaining the desired placements.

Considering then the actual yields given in table 1, it will be noted that the highest yield in the Maine work followed placement of the ordinary strength fertilizer in narrow bands 2 inches to the side of the seed-piece and 2 inches below the seed-piece level; the lowest yields where the fertilizer was applied either above or below the seed-piece.

In Michigan, best results were obtained when the fertilizer was applied on each side, 1 inch away; followed closely by the application 2 inches on each side, on same level, and the one 2 inches away and 2 inches below the seed-piece level. Lowest yields were obtained with applications above or below the seed-piece.

In New Jersey, the highest yield in the case of the ordinary strength mixture was obtained with a placement 2 inches to the side and 2 inches below the seed-piece followed respectively by the 2 and 4 inches to the side placements. The lowest yield was produced with fertilizer applied above the seed-piece. In New Jersey, as in the other potato growing sections, considerable fertilizer is applied in the furrow and mixed with the soil as the seed-pieces are planted. This would be equivalent to the second placement method which gave a yield of 235 bushels, 20 bushels less than the side placement methods.

In Ohio, the one inch to the side placement gave the best yield; the above-seed placement, in a band, the lowest, a difference of 17 bushels. The response to fertilizer treatment was not marked in the Ohio work.

In the ordinary strength mixture in Virginia, the range between the lowest yield (obtained with placement of fertilizer above the seed) and highest yield (fertilizer applied in furrow and well mixed with the soil) was 20 bushels. The other yields in the Virginia experiment ran fairly close together.

Taking the average yields for all states it will be noted that the

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aSix of the placements were similar in New Jersey, Ohio and Virginia, the variation being in the Maine and Michigan work. The No. 7 method also varied somewhat as shown in the chart.

TABLE 1.—*Potato yields obtained with different fertilizer placement methods in permanent soil types in 1932*

TABLE 1.—*Potato yields obtained with different fertilizer placement methods in permanent soil types in 1932*

Location of Fertilizer	Bushels per acre										
	Maine (Caribou loam)			New Jersey (Sassafras loam)			Virginia (Sandy loam)			Michigan (Montcalm sandy loam) 4-8-7	Ohio (Canfield silt loam) 4-10-6
	4-8-7	8-16-14	Ave.	4-8-7	8-16-14	Ave.	6-6-5	12-12-10	Ave.		
1. Under the seed piece in band 4-5 in. wide, with about 2 in. of soil intervening	290	267	278.5	229	243	236.0	128	121	124.5	168	155
2. In furrow, mixed well with soil	298	325	311.5	235	231	233.0	134	129	131.5	175	145
3. In two bands, 2 in. from seed piece, on same plane..	312	313	312.5	252	254	253.0	123	112	117.5	197	153
4. In two bands, 2 in. from seed piece and 2 in. below plane of seed piece	316	307	311.5	255	251	253.0	132	128	130.0	192	153
5. In two bands, 4 in. from seed piece, on same plane..	296	274	285.0	249	246	247.5	132	114	123.0	180	158
6. In two bands, 1 in. from seed piece on same plane...	295	305	300.0	...	248	...	122	95	108.5	199	161
7. Applied over seed piece in fairly wide arc with about 2 in. soil intervening	290	307	298.5	211	226	218.5	114	103	108.5	176	144
Average	299.4	299.6	....	238	242	....	126.4	115	....	....	....
Range in Yield (Bus.)....	26	58	....	44	25	....	20	34	....	31	17
Unfertilized (Bus.)	223	223	....	188	188	....	86	86	....	169	155
Greatest Yield Increase (Bus.)	93	102	....	67	66	....	49	43	....	30	6

Rate of Application in Maine, New Jersey and Virginia—2000 lbs. per acre.
Ohio, 1500 pounds per acre. Michigan, 800 lbs. per acre.
*The low yields in Virginia were the result of very dry weather conditions.
Variety grown in Maine, New Jersey, and Virginia—Irish Cobbler.
Michigan and Ohio—Rural Russet.

side applications proved to be somewhat superior. In 4 out of 5 states marked responses to fertilizer were evident, increases ranging from 8 bushels in Ohio to 93 bushels in Maine being obtained.

In comparing the effectiveness of ordinary- and double-strength fertilizers it will be seen from the table that, in Maine, the two types of fertilizer were equally effective; in New Jersey, a slight advantage was indicated for the double-strength; while in Virginia, the more concentrated fertilizer produced a lower yield.

Comparing the effectiveness of both fertilizer analyses under Aroostook County conditions, the average yield was practically the same, but there was a considerably greater range in yield in the case of the double-strength fertilizer. In New Jersey, the reverse occurred, the range being highest in the case of the ordinary-strength fertilizer. In Virginia, the greatest range in yield followed the use of the double-strength fertilizer.

Referring to the detailed studies on individual potato hills results for New Jersey in 1931 showed that fertilizer applied below the seed-piece gave fewer but larger tubers, in contrast with lateral placements which produced more tubers to the hill but of less average weight.

This same trend occurred with the detailed hill studies in Michigan in 1932, suggesting an interesting physiological effect from fertilizer placement. Detailed hill studies in Maine and Ohio in connection with the placement may throw additional light on the matter. If such an effect should be found to hold true generally it may prove to be of great practical interest to commercial potato growers.

Summary

Summarizing the results so far obtained it is fairly clear that:

Placement of the fertilizer as a side application, in equal bands on each side of the potato seed-piece, so far has proved superior to fertilizer applied below or above the seed-piece.

No great difference has been found between placement of the fertilizer to the side and on the same plane and placement to the side and below the seed-piece level; that is, a placement of fertilizer 2 inches on each side, same plane as seed-piece, has shown no significant difference in effectiveness from a placement 2 inches on each side and about 2 inches below the seed-piece level.

In a number of trials, particularly on heavier soil, placement of the fertilizer as far as 4 inches away from the seed-piece resulted in comparatively low yields. However, some experiments suggested that 4

inches away, under the weather conditions prevailing, proved very satisfactory.

Fertilizer applied above the seed-piece almost invariably produced lower yields than to the side placements when not too far from the seed-piece.

The results of individual hill studies disclosed that placements either above or below the seed-piece produced fewer but heavier tubers to the hill than lateral placements. This was brought out in the 1931 New Jersey results and again in the 1932 individual hill studies in Michigan. If it is found that such an effect is constant it is likely that it will prove to be of practical interest to potato growers who are accustomed to using comparatively heavy rates of fertilizer application.

No great difference was found in the effectiveness of ordinary-strength and concentrated fertilizer mixtures. The Virginia average yields for all placements were favorable to the ordinary-strength. The same comparison in Maine gave practically identical average results, while in New Jersey average results for the 6 placements made in 1931 and 1932 were higher with the double-strength mixture.

A report covering the 1932 fertilizer placement work was made to the Joint Committee on Fertilizer Application at its Meeting in Washington, D. C., on November 16, 1932. A special committee appointed to formulate recommendations decided that, "Best results have been obtained with potatoes when the fertilizer is placed in a narrow band on each side of the seed-piece, separated from it by two inches of fertilizer-free soil and in a depth zone from two inches below the seed-piece to the seed-piece level." It was further recommended that when planting across sloping land the placement below the seed level is preferred and that uniform distribution along the row is urged as essential to greater fertilizer efficiency.

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THE POTATO YELLOW DWARF DISEASE

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Satisfactory evidence of the artificial transmission of potato yellow dwarf has not been found in the literature. Inoculation experiments by artificial methods were reported by Muncie (1932) in which transmission may have been secured in a few cases. Fernow and Black (1932) claimed to have transmitted the disease in the field by stem grafting.

In correspondence between the author and Dr. E. S. Schultz, Schultz reports that he obtained transmission in an unpublished experiment performed in 1930. Twenty-five tuber grafts were made between yellow dwarf Green Mountains and healthy Bliss Triumphs. Transmission resulted in 11 cases whereas all non-grafted pieces from the same Bliss Triumph tubers remained healthy. So far as the author is aware this is the first experiment proving the transmissibility of yellow dwarf.

TRANSMISSION BY GRAFTING

In the winter of 1931-32 a grafting experiment was conducted in a greenhouse held at a temperature of about 27° C. Large healthy tubers were cut into four sets which were planted in separate pots. The stem of one of the sister plants was grafted with a healthy scion. The remaining plants from the same tuber were grafted with yellow dwarf scions. The results, presented in table 1, show conclusively that the yellow dwarf disease can be transmitted by stem grafts. The virus is therefore present in the vines. The incubation period, as shown in table 2, varied from 22 to 61 days with a mean incubation period of 38 days. One of the 57 plants which developed yellow dwarf did not show disease until the next vegetative generation, 282 days after inoculation. This plant is not included in table 2. Subsequent grafts made under other conditions have given incubation periods as short as 17 days.

FIELD OBSERVATIONS

In some instances seed potato growers in areas afflicted with this disease have planted Prince Edward Island certified Green Mountains.

*The writer wishes to acknowledge the helpful suggestions and encouragement of Dr. K. H. Fernow and Dr. F. M. Blodgett.

TABLE 1.—*Transmission of yellow dwarf by stem grafting (Greenhouse, 1932)*

	Grafted with yellow dwarf scions	Grafted with healthy scions
Total number of plants.....	61	21
Number developing yellow dwarf .	57	0

TABLE 2.—*Incubation period of yellow dwarf in the potato grafting experiment (Greenhouse, 1932)*

Incubation period in days..	22	25	28	31	34	37	40	43	46	49	52	55	58	61
Number of plants	2	4	2	9	5	8	10	3	5	2	4	0	0	2

Mean = 38 days. Range = 22-61 days.

The records of the New York State inspection service, as well as reports from the province, indicate that such stock is free from yellow dwarf. The earliest appearance of yellow dwarf in such fields, as reported by interested growers who know the disease, has been in the last week of July, i. e., about 10 weeks after planting. The type of symptoms found in these cases as well as the results of our own experiments suggest that probably this is about the earliest date for symptoms resulting from current season inoculation. Current season symptoms are common in some fields. While these may appear scattered throughout 5 or 10 acre plots, fields have been observed where the disease was obviously spreading faster on one side. In two cases of this nature the disease was most abundant on sides adjacent to hay fields and in another the side was contiguous to waste land.

The progeny from isolated seed plots has seldom shown less yellow dwarf than that from the main field and has frequently shown more.

Insect Transmission

In preliminary experiments three species of aphids occurring on potatoes, namely, *Myzus persicae* Sulzer, *Myzus pseudosolani* Theobald and *Macrosiphum solanifolii* Ashmead,* as well as the common

*The aphids were identified by Edith M. Patch.

potato leafhopper and the tarnished plant bug, have failed to transmit the yellow dwarf virus from potato to potato. The greenhouse whitefly has often been abundant on mixed populations of yellow dwarf and healthy plants, yet no cases of accidental transmission have occurred under glass. Evidence is given below that the clover leafhopper does transmit the virus of potato yellow dwarf. Samples of the clover leafhoppers used in these experiments have been identified as *Agallia sanguinolenta* Prov. by John L. Buys and D. M. DeLong.

In one experiment begun during the summer of 1933, Green Mountain tubers free from yellow dwarf were cut into four seed pieces and each set planted in a pot together with a Green Mountain tuber having yellow dwarf. Collections of insects, other than the non-vectors mentioned above, were made in fields badly infested with yellow dwarf. These were separated into specific or closely related groups and each group was added to a cage enclosing a single pot. At least one pot of the four from each tuber was left uncaged as a control. Since no current season symptoms appeared, the tubers from the originally healthy plants were harvested and, after storage, planted. The results, given in table 3, were obtained from the second vegetative generation. All 7 plants to which the clover leafhopper was added showed yellow dwarf, but of the 141 plants to which no clover leafhoppers were added only 3 showed yellow dwarf.

TABLE 3.—*Insect transmission of yellow dwarf, various insects collected from diseased fields in summer of* 1933 *and placed on healthy plants*

	Agallia sanguinolenta added	Sister plants no insects added	Sister plants other insects added	Additional plants, other insects added	Additional plants, no insects added
Total number of plants....	7	11	6	33	91
Plants developing yellow dwarf	7	0	1	1	1

During the winter of 1933-34, adults of *A. sanguinolenta* previously fed on a yellow dwarf plant were placed on two healthy plants in individual cages. Three sister plants were held caged without insects. One of the two plants on which the leafhoppers were placed developed yellow dwarf in the current season. The other four remained healthy. The progeny of these plants has not yet been grown.

From April 3rd to April 8th, 1934, collections were made of adult clover leafhoppers overwintering in grass land at the edge of two fields, the potatoes in which had been severely affected by yellow dwarf the previous summer. The adults collected (321) were transferred to 7 young healthy potato plants. The insects were not allowed to feed on any plants in the interim. Uncaged sister plants were retained as checks. Similar results were obtained with the leafhoppers from both fields (table 4). The 7 plants to which the leafhoppers were added developed yellow dwarf while the 21 sister plants remained healthy. This is additional evidence that these insects transmit the pathogene. Moreover it indicates that the virus overwinters either in the insect or in some host plant other than the potato.

TABLE 4.—*Transmission of yellow dwarf by Agallia sanguinolenta. Overwintering insects added directly to potato plants. Spring, 1934.*

	Agallia sanguinolenta added	Sister check plants, no insects added
Total plants	7	21
Plants developing yellow dwarf ...	7	0

The current season symptoms which were obtained in the insect transmission experiments developed in about 39 days. However, this period is variable.

The fact that the clover leafhopper is a vector of the yellow dwarf virus offers a good explanation of those cases in which the disease spreads more rapidly on the edge of the field. It also explains the inadequacy of the small isolated seed plot as a control measure in certain districts. The fact that overwintering adults are viruliferous may partly explain the early infection of healthy seed when introduced into affected areas. It may also account for the apparent harboring of the pathogene in the soil, as reported by Barrus and Chupp (1922).

These results may raise the question as to whether potato yellow dwarf is not due to a toxin produced by *Agallia sanguinolenta*. There are two arguments against this hypothesis: the lengthy incubation period (about 40 days) and the fact that the disease may be transmitted by a series of grafts to successive plants.

SUMMARY

Potato yellow dwarf is transmissible by stem grafting.

Several insects were tested for their ability to transmit yellow dwarf.

The clover leafhopper, *Agallia sanguinolenta,* Prov., is the only one which acted as a vector.

The incubation period for the virus in the plant is variable. It averaged about 40 days in these experiments whether tranmission was by grafting or by insect inoculation.

There are two ways in which the virus overwinters: (1) in the potato tuber and (2) in the clover leafhopper or in some host other than the potato.

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POTATO SPRAYING—THE VALUE OF LATE APPLICATIONS AND MAGNESIUM-BORDEAUX

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Spraying experiments have been conducted in Maine for nearly 30 years. In spite of the great amount of work done on this project in this state and elsewhere the losses from late blight are still enormous. In Maine the losses caused by this disease during a bad blight season probably amounted to from 10 to 12 per cent of the total crop in spite of expenditures to control it. The losses in other potato regions may also be very large.

During the years 1930 and 1931, the writer with Mr. Beverly and Mr. Dolloff, the local county agents, made extensive surveys in Aroostook County. This was done to obtain data regarding the seriousness of the prevalent late blight epidemics and to learn why many farmers failed to control this disease.

The results of these surveys are briefly as follows:

Year	No. fields observed	No. fields killed by blight (80% or more dead)	Percentage of total fields observed that were severely injured by blight attack
1930	670	553	82.5
1931	940	587	62.0

It was found that the majority of farmers had failed to control late blight successfully. For example, in 1930 more than four-fifths of all the potato fields had been killed or badly damaged by potato blight by the last week in August and in 1931 nearly two-thirds of the potato fields suffered because of poor blight control. According to tests then being conducted by the writer the fields should have been growing and producing potatoes until the middle of September. This early death of the potato plants was serious, due to the fact that the daily increase in yield for actively growing plants late in the season was from 8 to 19 bushels per acre.

Why was late blight not successfully controlled?

One might think that the kind of spray material used was the limiting factor in controlling late blight. The data secured by the surveys indicated, however, that this was not the case. Neither the kind of spray material used nor the method of preparation was the chief factor which determined the success the farmers had in combating the disease. Both good and poor disease control were secured with Bordeaux mixture of different strengths or prepared in different manners, and with other fungicidal materials.

It is also of interest to note that the kind of spray machine was not the chief factor that determined the success or failure of farmers in controlling late blight. There were growers who controlled blight well with horse-drawn traction-power outfits that applied only 80 or 90 gallons of spray material per acre at each application. There were, on the other hand, growers who failed to control blight with the best power-driven machinery applying 130 or more gallons per acre at each application with a comparatively high pressure.

Value of the late spray applications

According to the data secured through the survey, blight was well controlled with from 6 to 9 applications, by men who made most of their spray applications in late summer. The sprays that gave the largest returns were those applied from the last week in July until the first week in September. It apparently was the late sprays and not the early ones that gave the best results. The spray applications made early in the season did not appear to influence the control of late blight.

The value of the late sprays is further shown by the following yield data from results on Aroostook Farm in 1931, a very bad late blight season:

Treatment	Yield Bushels per Acre
None	330
Late applications omitted	327
Early applications omitted	415
Sprayed regularly (9 times)	415

It was found that most farmers began to spray early in the season, often when the plants were only from six to eight inches high. The common practice was to spray often until the first week in August and then to stop. Generally the spraying operation was terminated at the most critical period when there was most danger from a late blight epidemic. Growers commonly felt that a certain number of spray applications were necessary without regard to the time of season, the condition of the field, or the prevalence of disease. Better blight control and higher yields would have resulted if the growers had paid less attention to sprays applied early in the season and more attention to the late application at a time when blight is most apt to develop and spread.

Magnesium Bordeaux vs. Calcium Bordeaux

Potato growers often think that the failure to control late blight is due to the kind of lime used in the preparation of Bordeaux mixture. As far as could be determined through preliminary experiments in plots, there was relatively little difference in the degree of disease control with different brands of lime provided they were finely ground and had not been spoiled in storage. In 1931 hydrated lime and quick lime gave similar results to Bordeaux mixture in plot tests (Bonde, 1932, p. 209).

Recently it has been demonstrated that some soils in Maine are deficient in magnesium (Chucka, 1932, 1933, and 1934). It was shown further that potato plants grown in soil lacking this element develop a definite disease. This disease is characterized by stunting of the entire plant, yellowing of the leaves, leaf dropping, early dying and reduction in yield. It was learned that the addition of magnesium in the fertilizer would correct this trouble.

Chucka's results suggested the use of magnesium-lime in the preparation of Bordeaux mixture. Bordeaux mixture prepared with a magnesium or dolomitic lime was compared with Bordeaux made with a high-calcium lime on two farms that had been badly depleted of magnesium. (Bonde, 1934).

The results were very striking. The plants in the plots sprayed with the dolomitic lime spray showed signs of recovery within two weeks. They became dark green and stopped dying. Their rate of

growth began to speed up and they continued to grow until killed by frost. The plants in the plots sprayed with high-calcium lime spray on the other hand remained yellow and died early without giving a crop of good potatoes. The calcium Bordeaux plots gave unmarketable potatoes, all very small and rough. The plots sprayed with magnesium Bordeaux gave much larger tubers that were smoother and fit for sale.

The difference in yield was also very large as is shown by the following figures, representing bushels per acre.

Location	Soil Type	Calcium Bordeaux	Magnesium Bordeaux	Difference
Limestone	Poor	28	124	96
"	Better	253	290	37
Easton	Poor	66	154	88
"	Better	269	298	29

Conclusion

The climatic conditions of Aroostook County are somewhat different than for some other potato growing regions. The summers are relatively cool with an abundance of moisture. Insects are also relatively few in comparison with some other regions. The relative absence of insects and a cool climate mean that spraying in Maine is done largely for the control of late blight. It may also mean that spray practices that are suitable for this region are not necessarily the best for other potato growing areas. It is, however, very likely that the growers in some of the other potato growing regions make the same mistakes in their potato spray program as do the growers of Aroostook County and can benefit from the data included here.

It was learned that it is a common practice for growers to spray thoroughly and frequently early in the season before blight weather begins. Later, however, when the spray material applied in the early season has washed off and blight begins to spread, the fields are neglected with a resulting heavy loss. It would be more profitable to omit from one to three of the earlier applications and use the money saved for late spraying, providing there seems to be a need for it. In those potato growing sections where the potato leafhopper and flea beetles are abundant the omitting of the earlier spray applications probably would not be a good practice.

A dolomitic or magnesium—containing hydrated lime was found to be suitable for spraying purposes. On plants growing in magnesium deficient soils, the use of magnesium Bordeaux sometimes gives increased yields in comparison with calcium Bordeaux. It seems that Bordeaux mixture prepared with a dolomitic lime would be superior

to the high-calcium lime especially in those areas where the soil is deficient in magnesium.

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THE "PROFIT BUSHELS" IN POTATO PRODUCTION

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The total number of bushels of potatoes that a farmer grows is no indication of the amount of profit he will make from his crop. In fact, a farmer may have a large quantity of marketable potatoes, sell them at a fair price, and still lose money.

With potatoes at 50 cents per bushel it will require an acre yield of about 125 bushels to pay the cost of growing and marketing the crop. Therefore, a farmer may raise as many as 10,000 bushels of marketable potatoes and his crop still show a loss. Another farmer may have only 5,000 bushels and sell them at the same price per bushel and make a good profit from his potato crop; the difference is in the yield per acre.

If a farmer harvests 10,000 bushels from 100 acres or has an average yield of 100 bushels per acre, he lacks 25 bushels per acre of raising enough potatoes to pay expenses. Whereas, if the farmer with 5,000 bushels produces them on 16⅔ acres he has a 300 bushel yield or 175 bushels per acre above the cost of production. These are *profit bushels*.

While the object of each grower should be to produce as many profit-bushels as possible, it should also be his aim to produce these profit-bushels with as low a total production as possible. The higher the yield per acre the greater will be the per cent of profit-bushels. This is true because the acre cost of production is about the same whether the yield is high or low.

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*Delivered before the Nebraska Potato Improvement Association, Scottsbluff, Nebraska, March 16, 1934.

There are two factors which go to make potato growing profitable —the price per unit of production and the yield. It is not the total production but the acre yield of marketable potatoes above the acre cost of growing and marketing the crop that makes profit. It is possible to cut down the total production, which will stimulate higher prices, and still produce as many profit-bushels as from the higher total quantity. Where an acre yield of 125 bushels of potatoes is required to cover the acre cost of production, a yield of 150 bushels will return 25 bushels profit, while a 300 bushel yield will give a profit of 175 bushels. A 300 bushel yield, therefore, is approximately seven times as profitable as a yield of 150 bushels. It will require 70 acres yielding 150 bushels an acre to give the same number of profit-bushels as 10 acres yielding 300 bushels an acre. The 70 acres will produce a total of 10,500 bushels, while the 10 acres will produce only 3,000 bushels. Both fields produce the same number of profit-bushels, but in order to do so the 70 acres produce 250 per cent more potatoes than the 10 acres, or 7,500 bushels more. It is this 7,500 bushels which yields no profit and helps to create an over-production and low prices.

Here is a practical suggestion to the farmers who have signed acreage production contracts. When a farmer reduces his acreage of any crop it does not necessarily mean that he must reduce his profit bushels or tons. He can still produce the same number of profit units or even increase them and at the same time materially reduce his total production. It is the total production that the Government wants reduced.

The question arises how can one best get the greatest number of profit-bushels from his potato crop? This can be done by getting the maximum yield per acre. How to get high yields per acre depends on many factors, the most important of which is productive land. You must first have land that is capable of producing high yields. It is impossible to get high yields from poor run-down land.

Alfalfa or sweet clover improves the soil for potatoes. There is no better plan in the irrigation cropping system for potatoes than to have them follow 3 or 4 years of alfalfa.

Another important factor in the successful growing of potatoes is to follow a definite crop rotation system in which the same number of acres of potatoes are grown each year. There are good years and there are poor years, but don't make the mistake of trying to guess the good ones. Don't be an in-and-outer. An in-and-outer is the farmer who always has a large acreage when potatoes are cheap and no potatoes when prices are high. Growing potatoes under the in-and-outer system

is a most dangerous sort of gambling and usually it is followed by the class of farmers who can least afford to take a gambling chance. There is a very simple way to prevent these costly mistakes and that is by adopting a definite crop rotation system. A definite crop rotation system will do more than any other one thing to take the gamble out of potato growing. It will assure potatoes when prices are high and it will prevent a burdensome amount when prices are low. It will also, if a proper rotation is followed, increase the productiveness of the land so that higher yields and better quality will be produced.

The potato is an important crop in the North Platte Valley under irrigation. It has a higher possible acre return than any other of the main crops grown. The farmer who grows the same acreage of potatoes every year, grows them on alfalfa land, uses good seed and gives the crop the proper care, makes more money from his potato crop one year with another than from any other crop he grows.

On the other hand potatoes grown in a slipshod manner will lose more money than any other crop. The potato crop when grown by in-and-outers has caused more sad disappointments than any crop I know of, but when grown under proper conditions, potatoes have pulled more farmers out of financial holes and put them on their feet again in a short space of time, than any other two crops put together.

If you are going to grow potatoes, and I think most farmers of this section should, then grow the same number of acres each year, grow them on good clean productive land, use good seed, give them proper cultural treatment and harvest them carefully before they are damaged by frost and you will, over a period of years, make a profit from potato growing.

SECTIONAL NOTES

ARKANSAS

Potato digging in Arkansas is now well under way all over the state. This season there is very little variation in maturity of the crop from the Louisiana to the Missouri line. Shipments are reported from all sections. The crop this year is about ten days later than normal in maturing on account of early freezes and hot, dry weather later. The reported increase in acreage over last year's plantings, appears to be largely offset by light yields due to unfavorable growing conditions.

Examination of many fields shows that poor stands reported due to weather conditions have been caused by leafhoppers and tip and margin burn.

Heavy rains reported throughout the state will interfere some-

what with digging but more with the quality of the potato marketed. (June 12).—Wm. G. Amstein.

CALIFORNIA

Based on the actual yields in the Shafter District, taken together with an estimate of the remaining acres and their yields, it is clear that as of June 1st this year, the Shafter District has no more potatoes than they had at the same time last year. In other words, due to excessive shipments during May and to lighter yields, the tonnage resulting from the extra acreage this year has been overcome and the June production from the Shafter District will be somewhat lighter this year than last year. The probabilities are that there are about 500 cars less in the Shafter District as of June 1st than there was last year.

In the Los Angeles District the estimated production remaining on hand June 1st is about 2500 cars. This means that the State of California has no more potatoes that will be available in June and July than the State itself can use. Part of the production will be shipped out of the State so that by the time the Stockton District starts in the latter part of July, they will receive a ready market for their potatoes.

If there is any chance for the potato market to advance throughout the United States, California will be a contributing factor in the advance but the conditions in California are not sufficiently important to cause an advance. In any event, California will do nothing to prevent an advance. (June 8).—H. G. Zuckerman.

COLORADO

The potato situation in Colorado is very critical at this time. There have been no rains. Although the crop has not suffered to any great extent up to the present time, the future outlook is anything but bright. Many of the small streams failed to come through this spring and all other streams are as low as they normally are the first of August.

The only growers who are getting their full amount of water are those having the older rights on the larger streams. Unless an abnormal amount of rainfall is received, the potato crop will undoubtedly be very short.

All previous records for high temperatures and sub-normal precipitation have been broken and the fact that there is no snow in the hills makes the future outlook for water very discouraging. The season in Colorado is about three weeks earlier than normal and the move-

ment of early potatoes is expected to begin by June 25. (June 12).—C. H. METZGER.

The early potato crop of the Greeley district is in good condition at the present time. Recent rains have been very beneficial. The late crop is now being planted and it appears that a normal acreage will be grown this year.

Ground that was plowed late this spring is very dry and most growers are irrigating their potatoes soon after planting. Fall plowed land contains more moisture, and it is believed that it contains sufficient moisture to insure good germination.

Owing to the very mild winter, the potatoes left in the ground at time of harvest have germinated this spring.

The Colorado potato beetles are depositing eggs on volunteer potatoes and it is possible that the late crop may become infested with this insect this year. Ordinarily the Colorado potato beetle appears only on the early potato crop in this section. (June 8).—W. C. EDMUNDSON.

IOWA

Weather conditions in this section have changed but little from our May report and are anything but satisfactory. We are still waiting for the spring rains. Abnormally high temperatures prevailed throughout the month of May, accompanied by severe winds. This condition prevails throughout the Upper Mississippi Valley.

Early pastures and small grains are probably beyond recovery. The corn crop is surviving remarkably well, though the stand is rather spotted. In some fields there is sufficient moisture to start growth and the potato crop is doing as well as could be expected. In other places the seed pieces have not sprouted.

Within the past few days some sections have had a good rain and, according to the Weather Bureau, there are definite indications that the drouth is broken. Someone has said that "When Iowa is within the last 15 minutes of going to hell it always rains", so we are still hoping.

We are having hard sledding with our greenhouse potato seedlings. About half of them were transplanted the middle of May, but these were whipped pretty badly by the winds and the foliage wrecked. The next lot we shaded with shingles, with rather indifferent success. The third batch we transplanted into larger pots and are still holding them in the greenhouse, but they will have to face the music one of these

days in order to get by before the autumn frosts. (June 12).—A. T. ERWIN.

MAINE

Planting in Maine was practically completed by the first of June. Conservative, well informed operators estimate approximately a 10% increase over the acreage of 1933. This increase is accounted for by the price level for the past season and less restriction in acreage by credit agencies. There is some difference of opinion however, some feeling that the decline in price of stocks on hand May 1 has resulted in curtailment of original plans.

It is certain that there will be too many potatoes in Maine as elsewhere unless natural forces intervene to limit yields. Maine growers are dependent upon calamity in one form or another visiting other producing areas in order for them to secure an adequate market price for their own product, and vice versa.

We are all watching with great interest various plans for curtailing shipments in early states, in the hope that some plan may be found feasible that may be applied to all sections. More and more interest is being shown in the Agricultural Administration programs as it is being applied to various commodities.

The latest figures available of entries for certification of seed potatoes indicate only a slight increase over those of a year ago. Final figures will be released about June 20 and will be made available in the next issue of the American Potato Journal. The quality of the seed used this year is of the best; most seed producers securing new foundation stock largely from proven sources in Maine.

Planting conditions have been quite favorable this season, and through the use of better machinery the crop was planted in record time. The drouth has not affected potatoes appreciably here and with the arrival of heavy rains this week plenty of moisture is available for plant growth.

Considerable supplies of old stock are on hand even at this late date, June 14, and it now appears definitely certain that Maine would have shipped easily 50,000 cars if the price level had not dropped so low. The stock on hand is in cool cellars and keeping firm. It is being held for first of July shipment.

The Agricultural Financing picture has been made over markedly within the past year. Old obligations and farm mortgages are being assumed with some revisions by the Federal Land Bank and

Farm Commissioner Loans. When this process is completed there will be few private mortgages against Maine farms. Just what further changes there will be in farm financing it is difficult to determine, but we do know there has been a big transformation since the bank holiday was declared. (June 14).—FRANK W. HUSSEY.

MARYLAND

Early Irish potato acreage will be slightly lower than the harvested acreage of 1933. Due to excessive rainfall, stands are only poor to fair. The crop is a week to ten days later than normal on account of cold wet weather at planting time. In poorly drained fields and on wet places in all fields much seed rotted and many plants were weakened or killed. Due to the extensive use of certified seed most fields are very free from virus and other diseases. There has been a decided increase in the use of Bordeaux mixture for the control of flea beetle, leafhopper and early blight. (June 15).—R. A. JEHLE.

MASSACHUSETTS

Weather conditions in Massachusetts have continued favorable for the potato crop. Evidence of greater interest among growers in pest control for this coming season is seen in the early activities in spraying of fields. In some cases 3 and 4 sprays have already been applied by some of the better growers. (June 13).—RALPH W. DONALDSON.

MICHIGAN

According to crop reports of March, 1934, Michigan potato growers were planning to increase their potato acreage 5 per cent over that of 1933. Crop report figures for June are not yet available, and it is difficult to forecast the acreage. Drought and heat were severe over most of Michigan during May and the first week in June. Planting in many sections has been delayed two weeks or more for more favorable weather conditions. Many plantings made late in May in hot dry soil show considerable seed piece rotting and poor stands. Earlier plantings have come through quite well so far.

Observations made in the eastern section of the upper peninsula and in the northern counties of the lower peninsula June 7-10 showed the serious effect of drought on hay and pasture. Recent light rains and cooler weather have improved conditions materially in most sec-

tions of Michigan during the past few days. However, more rain is badly needed.

It is likely that there will be some increase this year in the acreage of potatoes listed for inspection. Applications for inspection are supposed to be filed by the 30th of June and accurate figures will be available at that time. The 1933 certified crop cleaned up at good prices and growers generally are feeling better over the seed deal. During the past two seasons there has been an increase in the seed production in the Upper Peninsula and the indications now are that the increase in seed acreage in that section this year will about double that of last year. This increase will be mostly in Green Mountains. Marquette, Baraga, Houghton and other counties specialize in Green Mountains for the table market. A large portion of the 1933 certified seed crop was used locally for growing better quality table stock.

Approximately 3,000 bushels of Katahdin potatoes were distributed to Michigan growers from special seed plots this year. Records secured from this seed during the season will give a good idea of the merits of this variety for Michigan conditions. So far the results have been discouraging. The Katahdin seems to come through drought and heat remarkably well and maintains its type when other varieties under similar conditions are badly off-type.

Approximately 40 acres of potatoes have been planted in experimental and demonstration plots at the Potato Experiment Station, Lake City. Planting was begun May 7 and finished May 22. Nearly half of the plantings will be irrigated by the porous hose system. Besides the irrigation work other experiments include date of planting tests, twin row planting, variety and strain testing, rotation experiments and potato breeding work. It is planned to hold a potato field day at the Station early in September. (June 12).—H. C. Moore.

NEBRASKA

At a recent meeting of the Nebraska Potato Improvement Association the following report of the potato machinery committee was unanimously adopted.

"The potato machinery problem is one of grave concern to the grower of all potatoes in western Nebraska. Your committee found, on investigation, that some equipment used by the farmer has been improved considerably from year to year, but we are sorry to say, that the manufacturers of potato machinery have lagged be-

hind in the race, and in some instances, might be said to be ten years behind the times. While this applies to a certain extent to all machinery, it is most glaring in the case of harvesting equipment. For this reason, we consider that to be of greatest value to the men at this meeting, and have confined our investigations chiefly to this type of machine.

"One of the worst faults of potato diggers, is the manner in which they damage the Triumph potato, which is in itself an easily damaged potato. We urge that this meeting go on record as recommending to the manufacturers of potato harvesting equipment the improvement of their machines to prevent to a greater extent, damage to potatoes.

"We urge attention to the following particular points:

1. Lowering of the general height to which the elevator chain lifts the potatoes, and subsequently has to drop them to the ground.

2. Using of a different type of elevator, to eliminate sharp points that bruise many potatoes.

3. Extending the length of the first chain, and elimination of the rear, short elevator chain.

4. Padding of the machine in several points where potatoes strike most frequently.

5. In the use of power take-offs provide for greater reduction of speed.—H. O. WERNER.

NEW JERSEY

New Jersey is estimated to have 37,400 acres this year as compared with 34,000 acres harvested in 1933. The condition of the crop is good. While some fields are injured in low areas from excess water the stand is good to excellent and the growing conditions have been favorable. The vines are now coming into full bloom. Very few fields have been observed where the virous diseases are likely to result in appreciable reductions in yield. A large portion of the crop is being sprayed with Bordeaux mixture or dusted with a copper-lime dust.

The New Jersey growers and dealers, realizing the need for orderly marketing of the crop, have organized under a plan similar to the one in operation last year. The twenty-one dealers in Central Jersey have agreed to sell through the offices, one at Hightstown and the other at Freehold. A quotation committee of dealers and growers are asked to agree to sell their potatoes only to those dealers represented in the central offices, making no sales to truckers. They also agree to discon-

tinue digging operations when this is considered to be necessary to prevent overloading Dealers and growers alike are hopeful that this plan will result in improved conditions in the industry in that unnecessary price cutting will be eliminated. (June 16).—Wm. H. Martin.

NEW YORK

Conditions on Long Island as of June 1st were excellent. There has been ample rainfall since the crop was planted and the earliest planted fields are now over a foot high. Colorado beetles are plentiful and eggs have been laid abundantly. In all other sections of New York, conditions are very unfavorable because of lack of rain. In general, planting will be late and many farmers hesitate to plant until more soil moisture is in sight. Some of the earlier planted fields show poor stands because the seed pieces rotted in dry soil.

During the week of May 20th, many of the fields planted on muck soil in Cayuga, Wayne and Madison Counties, were frozen back to the ground. This will delay the crop and probably reduce the yield somewhat in these sections.

The very disappointing prices received on the late spring market will probably discourage many growers who had planned to increase acreage this year.—E. V. Hardenburg.

NORTH CAROLINA

Harvesting has been somewhat late up to date and there have been about two thousand cars of potatoes shipped from the early potato sections. Last year on the same date there had been twice as many shipped. There have been heavy rains and rather cool weather up to the present week and the potato crop will be large. Last year our total shipments were somewhat over seven thousand cars. This year, with the heavy yields and increased plantings, the shipments will be at least nine thousand cars provided the price holds up. Potatoes seem to be in good condition, but still green and the growers are getting rather impatient to dig and put them on the market. (June 14).—Robert Schmidt.

OHIO

The dry weather has continued to be serious in Ohio. At Columbus, the deficiency of rainfall from January 1 to June 11 was 9½ inches. Within the past week, there have been some local thunder showers but no general rains. The early potato crop has suffered

materially from the hot, dry weather. Plants are short and the set is light. Some fields that have been irrigated are exceptionally fine. Digging no doubt, will be delayed until late July.

The early acreage in the Ohio River District is somewhat smaller than a year ago. Some of the potato acreage was planted to cabbage. The increased cost of growing potatoes because of the high price of seed was no doubt responsible for this shift of acreage.

The dry weather came so early this year that many growers did not get their plowing done; therefore, they have been held up in planting, waiting for rain. Best conditions for plowing in Ohio this year were in January. Those who plowed early and conserved their moisture have their late potatoes planted. There is still a considerable amount of late seed available in the state. This is due to the lack of rain as growers who did not plow early have held off buying. While recent figures on the late acreage are not available, it is my opinion that the late acreage will be materially reduced over last year.—E. B. Tussing.

PENNSYLVANIA

Most of western and northern Pennsylvania has been suffering from dry weather unprecedented at this season of the year. This was considerably relieved by more or less general rains and very local showers during the week of June 3rd. Eastern Pennsylvania has had so much rain that some stands of late potatoes are reported injured. In the drought area many fields were planted in hot, dry soil which may hurt the stand. Early potato stands are good. (June 13).—J. B. R. Dickey.

SOUTH CAROLINA

The potato season in South Carolina is practically over with some 3,200 cars having been moved out of the state to date.

The quality and yields were good during the first week of our shipping season. Heavy rains on May 28 and 29 caused some damage, as many of the potatoes dug during the latter part of that week were too dirty to make a U. S. No. 1 grade, and there was a small acreage covered by water which practically ruined the potatoes in those fields.

The F.O.B. price for No. 1's averaged around $1.75 to $2.00 per barrel during a greater part of the shipping season. The season was somewhat disappointing to the growers from a financial standpoint. (June 11).—George E. Prince.

VIRGINIA

The potato crop from Eastville to Kiptopeke (approximately one-fourth of the Eastern Shore acreage) has most excellent crop prospects. A few cars of potatoes were marketed the week ending June 9th. The yield ranged from fifty-five to sixty-five barrels per acre, but better yields are in prospect as the crop more nearly approaches maturity. The quality was excellent, and with the heavy showers which prevailed yesterday a fine crop is fairly well assured.

In the large central part of the Peninsula (one-half of the acreage) the crop is badly broken—the plants in general are making good growth and with one or two more rains, good quality stock will be produced and some good yields will be made. However, with the broken stand and some acreage which was injured badly by excessive rains, the average yield in this section cannot be large. Rather discouraging reports are indicated from the northern section of the Peninsula which grows twenty-five per cent of our acreage. The plants are small and rather dwarfed in appearance—some few fields are very good but on the average, this territory does not indicate a heavy yield per acre. It is a bit too early to give a definite picture of what will happen to this territory.

Shipments will be relatively light in the southern part of our territory during this week—the week of June 11th, but will become much heavier the succeeding week and continue so until our peak is reached some time during the first ten or fifteen days in July. (June 11).—G. S. RALSTON.

THE PRICE SITUATION

The following report on potatoes was released on June 15 by the Bureau of Agricultural Economics of the United States Department of Agriculture.

Potato prices in market centers declined steadily during May and the first part of June owing to the sharp rise in shipments of the new crop from the Southern Early States. Production in these states is forecast at 19,967,000 bushels or 28 per cent greater than a year ago while that in the first section of the Intermediate States, which are not yet shipping, is forecast at 12,677,000 bushels or nearly 41 per cent greater than in 1933. Usually prices of new potatoes decline during this period of the year, but with the large supplies of new potatoes now available or to be available for shipment during the next 2 months, the prospects are that the decline this season will be greater than seasonal. The present downward trend may be expected to continue until the northern late crop becomes the predominating supply factor.

Prices of old stock at New York declined from $1.90 per 100 pounds the first week of May to $1.37 the first week of June while those of new potatoes dropped from $3.00 to $1.84. A year ago old stock averaged $1.02 while new potatoes averaged $1.90 per 100 pounds. At Chicago, old potatoes declined from $1.22 per 100 pounds during the first week of May to $1.18 the first week of June. New potatoes dropped from $2.98 to $1.80 during the same period. On June 1, 1933, old stock averaged 96 cents while new potatoes averaged $2.25.

Shipping point prices followed much the same trend as market prices during the past month. Prices of Green Mountains at Presque Isle, Maine, averaged 70 cents per 100 pounds during the first week of June compared with $1.13 a month earlier. The 1934 Florida shipping season is about closed and F. O. B. prices at Hastings averaged $4.05 per barrel against $2.92 in 1933. The lower Rio Grande Valley Texas crop averaged $2.36 per 100 pounds this year compared with $1.95 last year. Shipments from North Carolina are just getting started with prices averaging around $2.00 per barrel F. O. B. shipping points.

The United States farm price of potatoes average 73.7 cents per bushel on May 15 compared with 83.4 cents on April 15, 43.7 cents on May 15, 1933, and 69.5 cents the May average from 1910 to 1914.

Shipments of new potatoes increased steadily during May, totaling nearly 4,000 cars in the last week of the month. By June 2 this year the movement of new potatoes totaled 17,600 cars against only 14,335 cars to June 3, 1933. On the other hand, shipments of old stock declined during the past month, totaling only 1,400 cars in the last week of May against 1,445 in the corresponding week a year earlier.

REVIEW OF RECENT LITERATURE

A survey of potato scab and fusarium wilt in western Nebraska. R. W. Goss, (*Phytopathology, Vol.* 24, (1934), *No.* 5, *pp.* 517-527).—A survey was made in 1928 in the high plains area of western Nebraska to determine the amount of scab and Fusarium wilt due to infection from the soil and the effect of various soil factors upon the incidence of these diseases. Portions of one lot of healthy treated Triumph potatoes were planted on each of 100 farms. Records were obtained of the cropping systems and cultural practices previously employed and determinations were made of soil type, reaction, organic matter, soil microörganisms, and other factors including weather records.

In general, 1928, the year of this survey, was one of the worst

scab years from 1925 to 1930. There were no fields entirely free from scab and the average of all fields was 10.5 per cent slight, 12.5 per cent medium, and 1.4 per cent severe scab with an additional 30 per cent of superficial or russet scab. Scab severe enough to require sorting out in order to meet a U. S. No. 1 Grade averaged over 50 per cent in 7 fields, 25 to 50 per cent in 12 fields, and 10 to 25 per cent in 21 fields. One field of virgin soil had 67 per cent scab. The average amount of Fusarium wilt infection as determined by stem-end rot or severe vascular discoloration was 4.5 per cent in 94 per cent of the fields. There were 9 fields with 10 to 20 per cent and 1 each with 30, 33 and 47 per cent. The latter was a field never before planted to potatoes and the one with 30 per cent infection was virgin soil.

The least scab occurred on soils planted the previous year with small grain, no significant differences occurring with wheat, oats, rye, or barley. Alfalfa and sweet clover the previous year resulted in more scab than small grains but slightly less than corn, while the most severe scab occurred on fallow soil. The application of manure two years previous to potatoes did not result in increased scab. There was no significant difference in the amount of Fusarium wilt following these various cropping systems.

None of the fields had been planted to potatoes during the previous two years. The highest percentage of scab (31 per cent sort-out) was for those with a 2 to 4 year interval between potato crops, while those not planted to potatoes for more than 4 years had 12 per cent and those never before planted to potatoes averaged 10 per cent scab sort-out. There was no significant difference in the amount of Fusarium in these groups.

Late planting did not reduce the amount of scab as usually occurs but actually increased it, possibly due to the high rainfall during June and July followed by dry weather in August and September. More scab occurred on silt loam soils than in the fine sandy loams.

The most outstanding result of the survey was in relation to soil reaction. Fifty-six per cent of the fields tested above pH 7.0. Only one field was below 6.3 and seven fields above 8.0. Contrary to many results reported from other states there was a decrease in scab with increasing alkalinity, from 68 per cent total and 16 per cent severe scab in the lowest pH group (5.9 to 6.5) to 30 per cent total and 8 per cent severe scab in the highest pH group (8.0 to 8.3). This decrease in scab paralleled a decrease in both numbers and percentage of Actinomyces in the soil.

The results reported are considered of value in opening up further lines of inquiry, particularly as regards the effect of previous crops and of soil reaction, rather than as a practical recommendation for the control of these diseases.—AUTHOR.

A potato disease, DONALD REDDICK *(Phytopathology, Vol. 23 (1933), No. 7, pp. 622-624).*—This trouble appeared in the greenhouse and field at Ithaca in late August, 1932. Symptoms appear first in the apical leaflets. The leaflets begin to cup downward and show numerous darkish areas on the underside. The tips of shoots begin to turn brown and from day to day become browner and very brittle. In the meantime the undersides of the leaflets assume a glossy appearance followed by a bronzing of the whole area. The leaf petiole becomes brittle and the leaf breaks off with a touch. Axillary shoots pass through these stages rapidly and die completely. The stalks and fully matured leaves may remain green for a long time or they may die rather promptly, apparently depending on the age of the plant when first attacked. Tuber formation is checked as soon as the disease is contracted. The disease, caused by a mite *(Tarsonemus* sp*)* is readily communicated by grafting and by leaf mutilation with diseased material. In the field the mite was readily controlled by an application of lime sulfur solution and sulfur dust. Fumigation in the greenhouse with naphthalene was found to be effective in the control of the disease.

Influence of spray applications on air temperatures surrounding sprayed potato plants, H. R. ROSEN *(Phytopathology, Vol. 23 (1933), No. 11, pp. 912-916, fig. 1).*—The author reports that excellent results in controlling tip and margin burning in the northern, hilly part of Arkansas followed applications of Bordeaux mixture while in the southern or coastal plain part of the state, little or no benefit followed. In the latter section any control of hopper injury was more than offset by the amount of spray injury, in sharp contrast to the favorable results secured in the northern part of the state where lower temperatures prevailed. It was found that the air temperature surrounding the sprayed plants dropped from 3.1 to 16.8° F. immediately following spraying. It is suggested that in sections with prevailing high temperatures during the latter half of the season, temperature drops following spraying would be much greater than in the cooler sections. The author raises the question as to whether spraying in warmer sections is attended by greater risks in so-called spray injury than in the cooler parts.

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THE NECESSITY FOR ORDERLY MARKETING

Low prices frequently result from the growers' tendency to rush his crop on the market without consideration of market demands. When prices are declining some growers become panicky and attempt to load as many potatoes as possible before there is a further decrease in price. The outcome is overloading and still greater reduction in prices. Some very good examples of the results of overloading the market are already apparent this year. Prices have never been maintained by glutting the market! When the markets are over-supplied, the only relief is to discontinue harvesting operations.

This matter is entirely in the growers' hands. The average dealer has but little control over the number of cars loaded in a day. Under the usual plan of operation, he accepts all potatoes brought to the loading station. If the grower would exercise the power he has to maintain prices, there is little question but that a higher price level would prevail during the average season.

In addition to harvesting and loading too rapidly, there is very often a tendency to slight the grading operation in a year when the price level is low. A poor quality product results and this tends to still further depress the price. In any year, but particularly in those years when prices are low, the grower should make every effort to see that the crop is carefully graded. Only the best should be shipped; the off-grade stock should be kept at home.

Careful grading, together with orderly harvesting and loading, particularly in the early and intermediate states, is certain to result in improved conditions in the potato industry. The section or individual who attempts to rush the harvesting operations at the expense of his neighbor only succeeds in hurting the entire industry. If each individual shipped his fair quota over a given time period, a much more stabilized industry would result.